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PROGRESS REPORTS

FROM

EXPERIMENT STATIONS

SEASON 1951-52

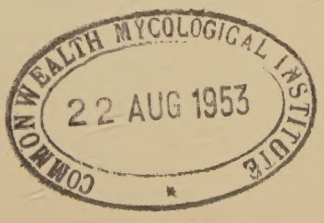
TANGANYIKA TERRITORY
EASTERN PROVINCE

(COVERING SEASONS 1950, 1951 and 1952)

PUBLISHED BY

THE EMPIRE COTTON GROWING CORPORATION,
12 CHANTREY HOUSE, ECCLESTON STREET,
LONDON, S.W.1.

1953



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TANGANYIKA TERRITORY.
EASTERN PROVINCE.

PROGRESS REPORT FOR THE SEASON 1950, 1951 and 1952

BY

A. G. BEBBINGTON and H. J. DE S. DISNEY.

Planting: Mid February to mid April.

Picking: July to October.

Uprooting: By 31st October.

Rainfall: January-June 1950 ... 30·81 ins.
January-June 1951 ... 31·90 ins.
January-June 1952 ... 28·50 ins.

INTRODUCTION.

The report covers the work on the Government experimental station at Ilonga and on four district plots.

Station.—During the three years four European houses, the labour lines, the office and laboratory buildings and a new ginnery building were completed. Some of the difficulties encountered in clearing tumble-down fallow land were the rapid growth of *Panicum maximum,* which was difficult to bury, and the presence of large quantities of buffalo beans (*Mucuna spp.*), the pods of which are covered with stinging hairs. In the early stages labour shortage was acute, and the machinery available was not suitable, until in *1952* two tractors and implements were purchased by means of a grant made by the Eastern Province Committee of the Lint and Seed Marketing Board.

Seasonal conditions.—The *1950* season was excellent for both cotton and food crops, rains being early and well distributed. In *1951,* after scanty rains in January, maize was established on good rains in February, and cotton from mid March onwards. In *1952* most maize crops in Kilosa district were partial or complete failures, owing to uneven distribution of rain during March and April, but the station was fortunate in having well distributed, though sub-normal, rainfall, and was thus able to supply about 38 tons of maize seed to surrounding farmers.

Cotton Breeding.

The most important results of the strain trials carried out in *1950* and *1951* are given in table 1.

Table 1.

Yields of seed cotton in lb. per acre.

1950 Trials.

	Local	*MU8*	*47SB*	*48SB*	*av. of 7 strains*	*Remarks*
Ilonga	86	94	116	133	124	*Heliothis & Earias*
Mvomero	306	436	420	402	389	
Mkundi	83	219	133	145	143	*Heliothis & Earias*
Dakawa	245	234	239	296	265	Rat damage
Kissaki	549	539	687	744	671	
Average	254	304	319	344	—	

1951 Trials.

	Local	*47SB*	*47/10*	*48SB*	*av. of 8 strains*	*Remarks*
Ilonga	660	748	743	739	732	
Mvomero	144	150	188	173	157	Late planted, poor rainfall
Mkundi	161	209	213	227	204	Late planted, poor rainfall
Dakawa	452	533	567	594	519	
Kissaki	439	479	608	628	535	
Average	371	424	464	472	—	

Past experience has shown that higher yielding strains are more liable to insect attack than are lower yielding strains, and this tends to mask the real differences. There is no doubt, however, from yield figures and from personal observation in the field, that the newer strains, and particularly 47/10 which is outstanding for lint quality, are much superior to Local.

In *1952* a large area was planted with 47/10 in order to multiply it for general distribution in place of Local.

Insect Pests.

Insect pests are without doubt the limiting factor in the production of cotton in the Eastern Province, and a very large proportion of the work is accordingly devoted to them. In all three seasons work included routine recordings of all pests on cotton at Ilonga and on the district plots, and of the incidence of *Heliothis* and *Dysdercus spp.* on hosts other than cotton, and insecticide trials; in *1950* and *1952* there was in addition insectary work on larval instar and pupation periods of *Heliothis.*

Bollworms.

American bollworm (*Heliothis armigera*).—This pest is present in the neighbourhood of Ilonga in very variable numbers at any time of year, being found during the colder and damper months in maize gardens in favourable sites near the permanent streams.

In *1950* the early rains led to very large stands of the common weeds *Portulaca oleracea* and *Tridax procumbens* in the fallow lands on the station in December and January, in which very large numbers of larvae were found in February. The generation bred up on these then bred a further generation on early planted maize, which resulted in a heavy attack on cotton in May and June, causing very severe loss of crop. A very general survey of the extent of attack on native gardens in Kilosa and Morogoro districts and on a number of estates showed that where cotton had been planted in February a good part of the early crop had been saved, while the March plantings had all lost heavily. February plantings were possible in *1950* owing to good early rains, which resulted in December and January planting of a large proportion of the food crops; unreliable rains in these months make this impossible in most years.

In *1951 Heliothis* was found in March on December-planted native maize. The main maize crop was planted in January and February, and carried a heavy population during April. Much cotton around Ilonga was planted late and made poor growth; all this yielded very poorly owing to heavy *Heliothis* attack. On the station itself the attack was very varied, parts of some fields escaping almost entirely; the section including the single plants yielded at the rate of 900 lb. seed cotton per acre, while yields from other fields were extremely low.

In *1952* the attack of *Heliothis* was the most severe ever experienced at Ilonga, and was very heavy on the district plots also. Larvae were found in moderate numbers during January on native maize planted in October and November *1951,* and were recorded until April, by which time most of the maize crops had failed through poor rains. On the station, the main maize crop was planted in February, and a large population built up on this during March, reaching a peak at the end of April, and persisting in some numbers into May and June on the later planted maize. At the same time larvae were recorded on dwarf sorghums planted at Ilonga for the first time. The attack on cotton resulting from this breeding-up started early in April, on March-planted cotton, three weeks before flowering began. The population was then only of the order of 140 larvae per acre, but egg-laying was at the rate of 1,360 per acre. Flowering commenced on 5th May, delayed to some extent by this early attack. The population increased rapidly and by 28th May had reached a peak of 28,550 per acre in the control plots of the insecticide trial, while at the same time it had reached

44,000 per acre in the routine recording cotton plots near by. This resulted in the loss of practically all squares and bolls and the larvae were reduced to eating the leaves. Sixth instar larvae were found dead at this time and the population steadily declined until the larvae disappeared in the middle of August.

As a result of this attack practically no crop was obtained from any of the cotton on the station which was not treated with insecticide. Attacks of *Heliothis* developed on all four district plots but none was of the same intensity as that on Ilonga. They did, however, cause very considerable loss of crop which has greatly hindered the bulking up of the strain 47/10 with which all these plots were planted.

The routine recording of *Heliothis* on its wild and cultivated hosts consisted in *1950* of larval counts at weekly intervals on samples of, where possible, one hundred herbaceous and crop plants, and included flowering, fruiting and general plant development. *Heliothis* has been recorded on all the following plants, though it is not certain that all are true hosts as it has not been possible to carry larvae through to maturity on all of them.

A. *Crop plants.*	B. *Wild plants.*
Maize	*Portulaca oleracea*
Cotton	*Tridax procumbens*
Chick pea	*Hibiscus physaloides*
Sunflower	*Hibiscus panduriformis*
Dolichos	*Hibiscus esculentus*
Groundnuts	*Abutilon spp.*
Tomatoes	

In the seasonal conditions of *1950 Portulaca* and *Tridax* were the most important wild hosts; only small numbers of larvae were found on *Hibiscus spp.* after the attack on cotton had started. In *1951 Heliothis* was recorded on sunflower in April and May and on pigeon pea from March to December; a large population was observed on chick pea on the station in June.

Insectary work was carried out in *1950* on the estimation of the duration of different larval stages of *Heliothis.* Observations were made on larvae fed on three crops, during the period January to August.

TABLE 2.

NUMBER OF DAYS IN EACH INSTAR—FIGURES BASED ON THE HIGHEST FREQUENCY OF OCCURRENCE.

Food	*Egg.*	*1st*	*2nd*	*3rd*	*4th*	*5th*	*6th*
Maize	4	3	2	2	2	3	3-4
Cotton	4	3	3	4	3	3	7
Sunflower	4	3	3	3	3	3	5

Spiny bollworm (*Earias spp.*).—In *1950* populations in cotton were larger than usual. Larvae were first recorded at the start of flowering in May and large numbers were taken in June and July. Similar populations were recorded in *1951,* and in *1952* after appearance in some numbers at the beginning of May a peak of some 6,000 per acre was reached by the middle of June, adding to the loss caused by *Heliothis.*

Pink bollworm (*Platyedra gossypiella*).—Both on Ilonga and the district plots numbers were negligible in *1950.* Early in the *1951* season, populations were larger than usual, possibly owing to the fact that rats had dragged a large amount of seed cotton from the plants in the previous season; though much of the seed was destroyed, some was still viable and this, germinating with the first rains, would in effect give a standover crop in which *Platyedra* might breed. Attack was nowhere serious in *1952.*

Stainers (*Dysdercus spp.*).

In *1950* recording on herbaceous plants was carried out as for *Heliothis.* Records of stainer on these annual and perennial plants are difficult, and only trends of population and breeding points can be observed. Recording on tree hosts is simpler, as a known number of trees can be marked and definite rounds established. Accurate figures can rarely be obtained and the records are still incomplete, but the following points are noted.

D. intermedius.—The main host appears to be *Sterculia appendiculata.* It is also found on *S. africana* and *S. quinqueloba.* In *1950* a large population built up on *Hibiscus physaloides,* which was very common in the bush and fallow lands; when these plants dried up the stainers moved on to cotton in late June, but there was little breeding in cotton until August. After the cotton had been picked large numbers were found in kapok plantations.

D. fasciatus.—This was recorded on several hosts, but appears to prefer kapok (*Ceiba pentandra*) and Baobab (*Adansonia digitata*). It did not appear in any number in cotton in *1950* until the bolls began to open, when a large invasion took place with subsequent breeding.

D. nigrofasciatus.—In *1950* this species was recorded in numbers on herbaceous hosts, in particular *Abutilon spp.* and *Hibiscus calyphylus,* which it seems to prefer to cotton. However, on the drying up of these hosts a large population was established in cotton from the beginning of July onwards.

D. cardinalis.—Only negligible numbers were observed in the *1950* cotton crop, late in the season. It was recorded in quantity on herbaceous hosts, especially *Hibiscus micranthus* and *H. vitifolius.*

General.—In *1951* stainers were not observed in large numbers except on the station and one of the district plots. At Ilonga the migrant population reached 1,000 per acre at the end of May and caused considerable damage in the early crop; the population fell towards the end of June and no breeding took place in the crop. On the district plot they appeared too late to cause any serious damage.

In *1952,* probably owing to the extent of damage by *Heliothis,* the influx of stainers was very small early in the season, and not until August was any considerable population recorded. *D. intermedius* and *D. fasciatus* then appeared and bred in the open bolls. The proportion of stained lint was very low.

Helopeltis bergrothi.

Some damage was caused at Ilonga from the end of May to the end of June, *1950,* by small numbers of this pest. Populations were negligible in *1951,* but in *1952* rather more damage was recorded; in the case of the native gardens this could be correlated with an increase in the amount of castor (*Ricinus communis*) planted.

Calidea dregei.

Though recorded only in small numbers on cotton, a large population appeared on dwarf sorghums at Ilonga in April *1952,* and some breeding took place. It was thought that there would be migration into the nearby cotton as the sorghum ripened off. Accordingly, hand-picking of the area was carried out. On 22nd April, 2,509 adults, 6 first instar nymphs and 11 egg batches were collected from just over an acre. A week later a second collection of 1,168 adults was made with batches of first to fourth instar nymphs and 93 egg batches.

A large population also developed on a collection of *Hibiscus* species planted on the station. No increase in numbers of *Calidea* in the cotton was recorded when *Hibiscus* became unattractive. It is not known where the influx came from or to what host they went.

Lygus vosseleri.

A small amount of damage was caused by this pest in *1952* to cotton planted near dwarf sorghum, where some breeding had taken place.

Aphis gossypii.

In *1952* some damage was caused in plots to which DDT was applied, owing to the killing off of the Coccinellids and Syrphids.

Insecticide Trials.

Dusting trials were carried out in all three years, the insecticides used including DDT, BHC, Toxaphene and nicotine sulphate in various formulations and mixtures, which were applied by rotary hand dusters. For the sake of brevity, details are included in tabular and diagrammatic form.

Table 3.

1950 Insecticide Trial.

Randomised block form; split blocks, 6 replications.
Plots 1/10 acre, separated by 3 rows of sorghum.
Planted on 12th March; good stand obtained.
First dusting on 17th May; second 20 days later, remainder at 10 day intervals, rate 16 lb. per acre.

Treatment	*Insecticide*	*No. of applications*	*Yield lb. s/c per acre*
D5	10% DDT in talc	5	537
D3	10% DDT in talc	3	372
T5	Toxaphene 20%	5	429
T3	Toxaphene 20%	3	221
M5	5% DDT+3% gamma BHC in talc	5	331
M3	5% DDT+3% gamma BHC in talc	3	196
G5	3% gamma BHC in talc	5	48
G3	3% gamma BHC in talc	3	65
C5	Control	5	101
C3	Control	3	102

Notes on 1950 Trial.—Owing to delay in delivery of the insecticides, the second application was made 20 days after the first instead of 10, and this period unfortunately coincided with maximum *Heliothis* activity. As a result of this delay, the trial does not give a full picture of the real effect of the dust. The increase in shedding in the DDT plots 11-12 days after the first dusting indicates that this dust does not persist for more than 10 days; the peak of shedding in the week ending 11th June in these plots would probably have been much reduced if the dust could have been applied on 27th May, since there was an immediate drop in shedding after the second dusting.

Of the crop set to 18th June which finally matured, in the control plots, 66·4% was either completely rotted or grade III due to bollworm as against 38·4% in the DDT plots, of which a proportion must be attributed to *Earias,* which DDT did not seem to be so effective in controlling.

The 10% DDT treatment applied five times was significantly better than all other treatments, while 20% Toxaphene applied five times was significantly better than all except DDT applied five and three times. It is obvious that three dustings do not give the necessary period of protection to the crop. The reason why BHC plots yielded less than the controls is not understood; no phytotoxic effects were observed.

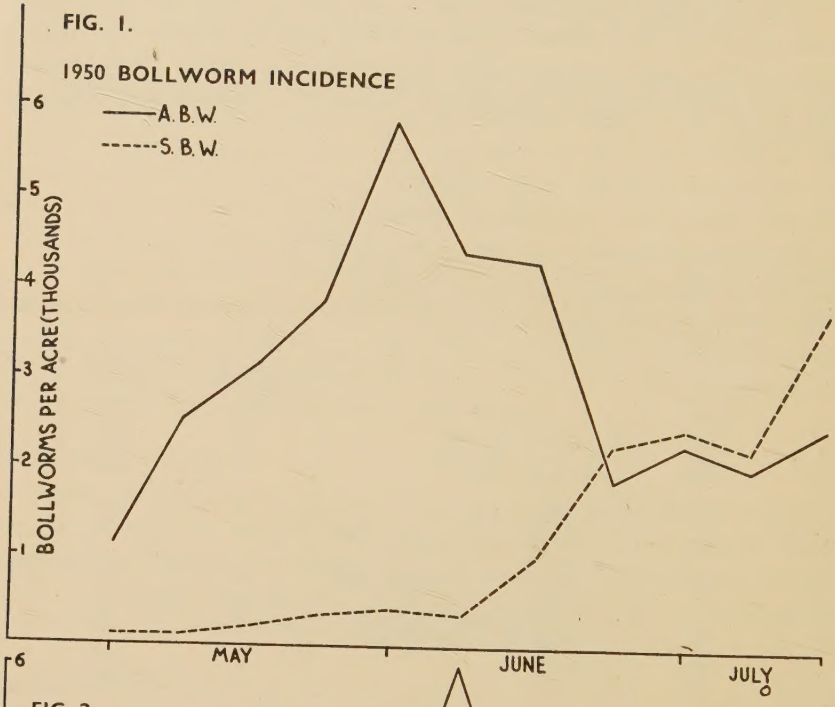
FIG. 1.
1950 BOLLWORM INCIDENCE
A.B.W.
S.B.W.
BOLLWORMS PER ACRE (THOUSANDS)
6
5
4
3
2
1
MAY
JUNE
JULY

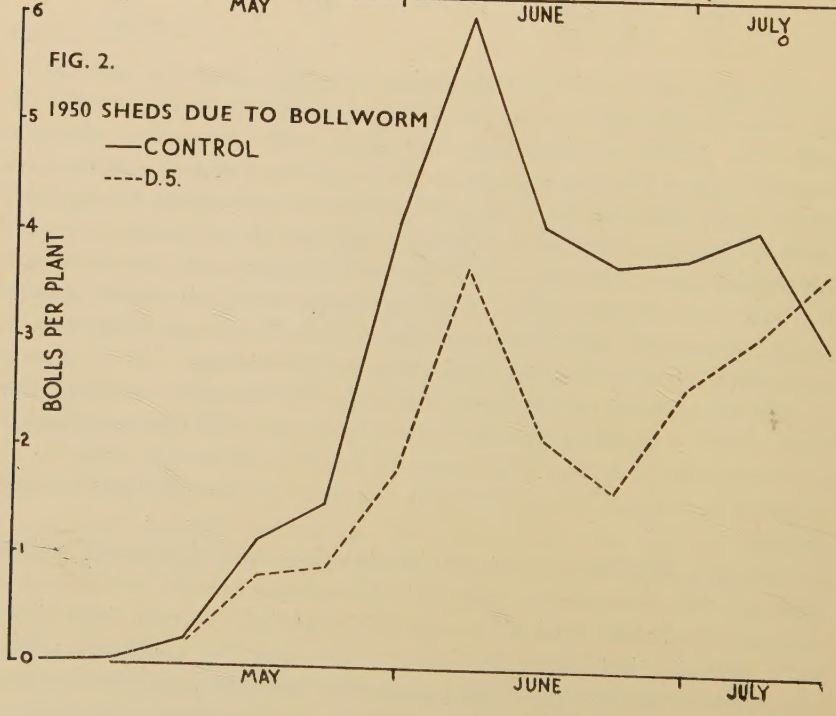
FIG. 2.
1950 SHEDS DUE TO BOLLWORM
CONTROL
D.5.
BOLLS PER PLANT
6
5
4
3
2
1
0
MAY
JUNE
JULY

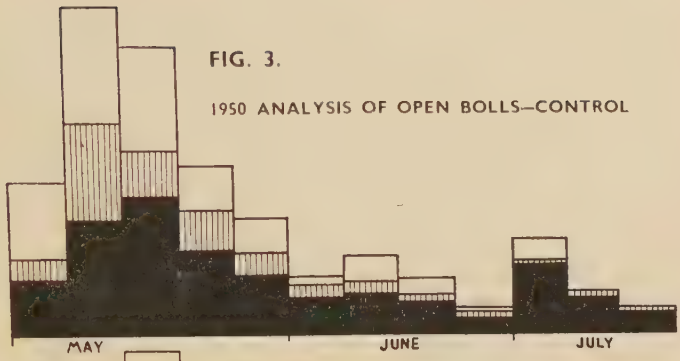

FIG. 3.

1950 ANALYSIS OF OPEN BOLLS—CONTROL

FIG. 4.

1950 ANALYSIS OF OPEN BOLLS—D5 TREATMENT

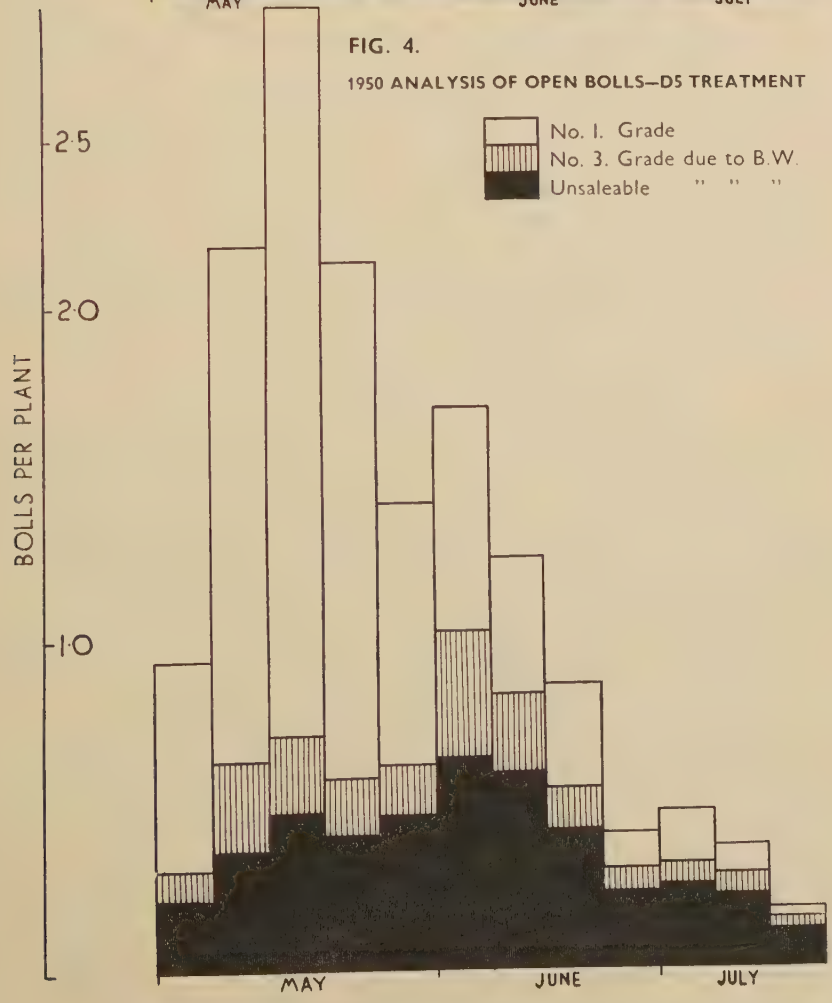

TABLE 4.

1951 INSECTICIDE TRIAL.

Randomised block form, 6 replications (one later abandoned owing to error in application of dust).

Plots 1/10 acre, separated by 6 rows of giant sorghum.

Planted 14th March; first dusting 26th May, subsequently at 10 day intervals; rate 16 lb. per acre.

Treatment	*Insecticide*	*No. of applications*	*Yield lb. s/c per acre*	*% in Grade I*
DG5	10% DDT 3% gamma BHC in talc	5	904	81·7
DG3	10% DDT 3% gamma BHC in talc	3	602	72·6
DN5	10% DDT 2% nicotine sulphate in talc	5	610	68·5
DN3	10% DDT 2% nicotine sulphate in talc	3	515	63·4
D5	10% DDT in talc	5	588	67·6
D3	10% DDT in talc	3	428	58·7
G5	3% gamma BHC in talc	5	224	64·6
G3	3% gamma BHC in talc	3	161	55·5
C	Control	—	324	52·9

Notes on 1951 Trial.—Bollworm attack was much more mixed than previously, *Earias* and *Platyedra* playing a much larger part. Individually these larvae do less damage than *Heliothis,* but constitute a real danger to the crop when present in large numbers.

As shown in Fig. 6, the DDT/BHC mixture gave considerable control of *Heliothis*, but less of *Earias* and *Platyedra.*

The treatment of 10% DDT plus 3% gamma BHC applied five times significantly outyielded all others at the 1% level, while the treatment with 3% gamma BHC alone was significantly below control at the 5% level.

From observations on the kill of the different insecticides it appears that although 3% gamma BHC gives an immediate kill of bollworm, in higher quantity than the other mixtures, it very soon loses its effect as compared with DDT, so that the plant is left unprotected for a considerable period between dustings.

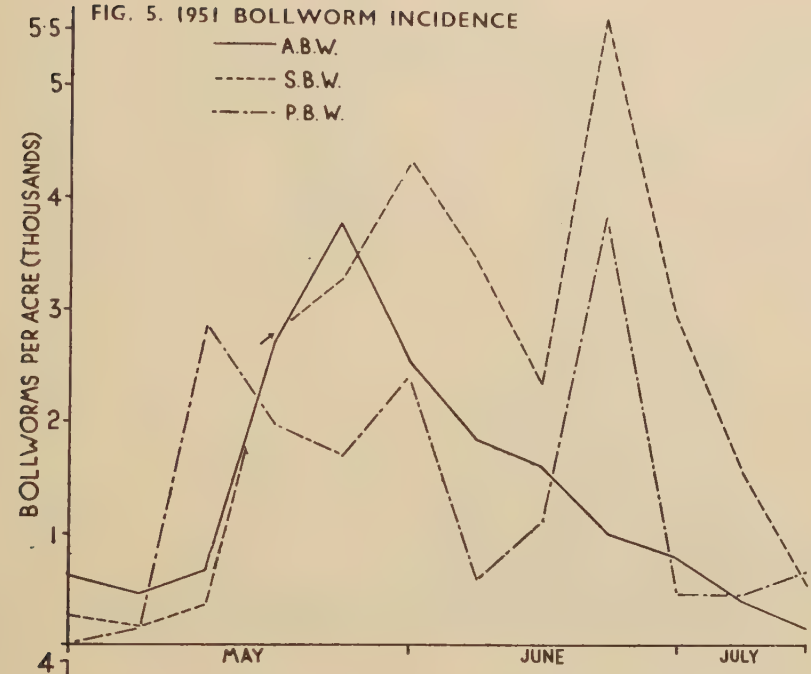
FIG. 5. 1951 BOLLWORM INCIDENCE
A.B.W.
S.B.W.
P.B.W.
BOLLWORMS PER ACRE (THOUSANDS)
5·5
5
4
3
2
1
MAY
JUNE
JULY

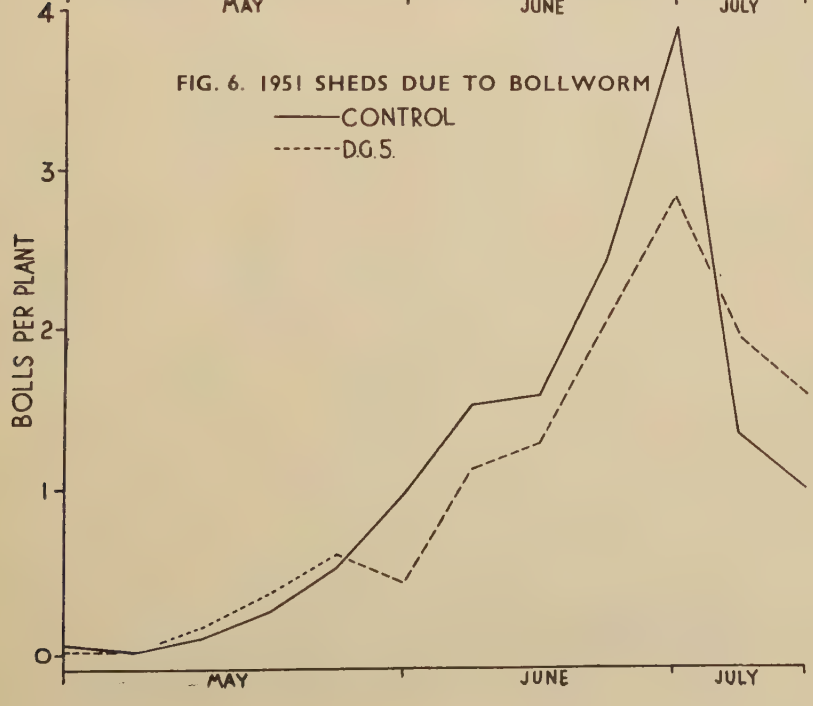
FIG. 6. 1951 SHEDS DUE TO BOLLWORM
CONTROL
D.G.5.
BOLLS PER PLANT
4
3
2
1
0
MAY
JUNE
JULY

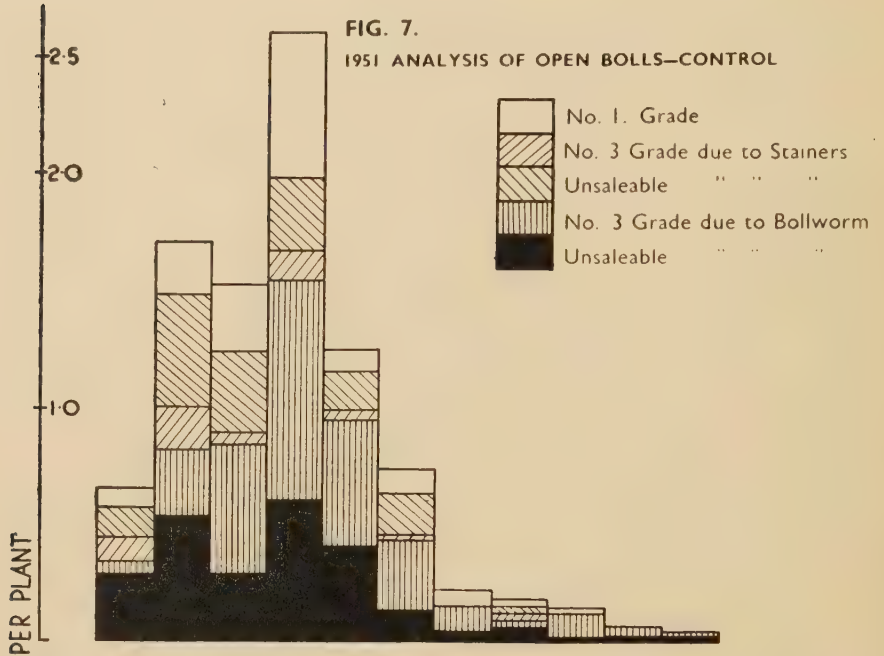

FIG. 7.
1951 ANALYSIS OF OPEN BOLLS—CONTROL

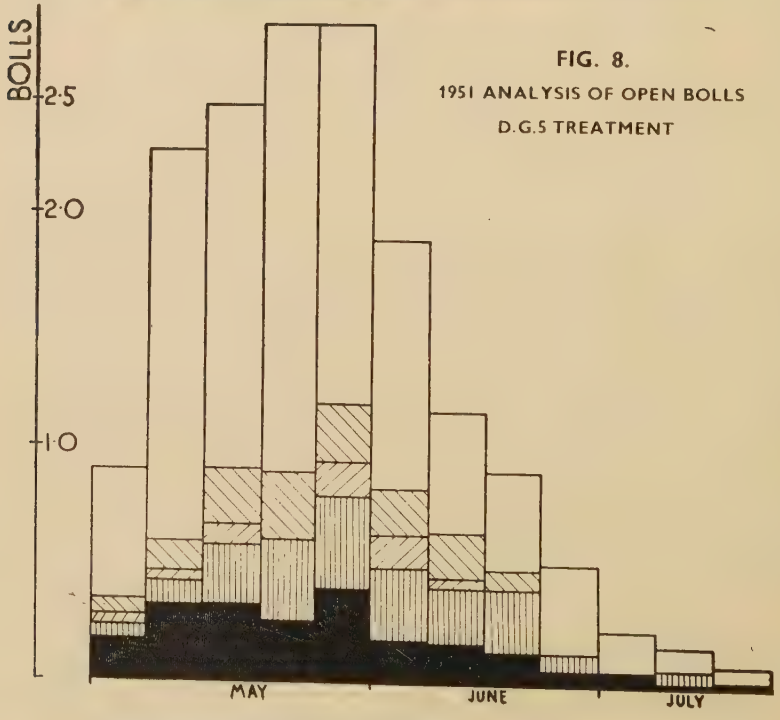

FIG. 8.
1951 ANALYSIS OF OPEN BOLLS
D.G.5 TREATMENT

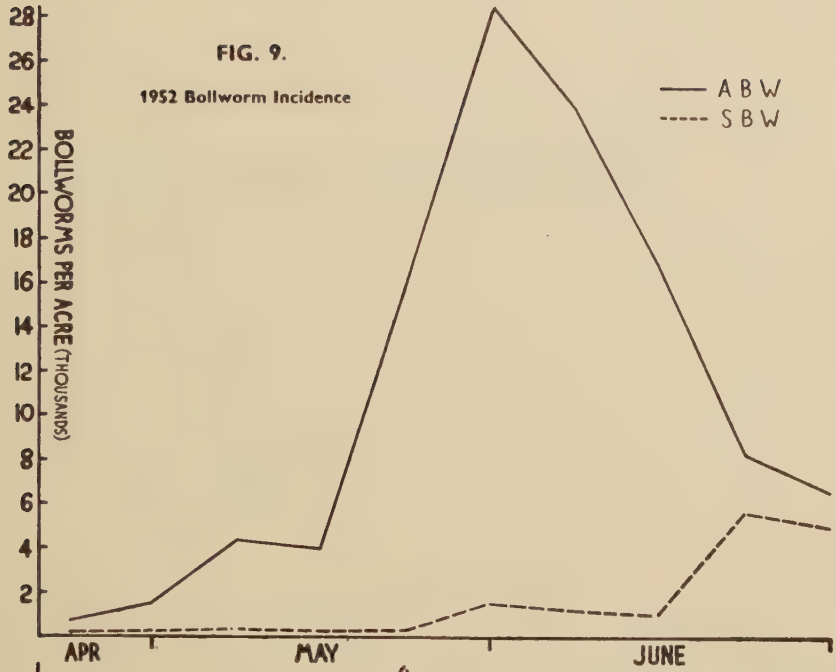
FIG. 9.
1952 Bollworm Incidence
A B W
S B W
BOLLWORMS PER ACRE (THOUSANDS)
28
26
24
22
20
18
16
14
12
10
8
6
4
2
APR
MAY
JUNE

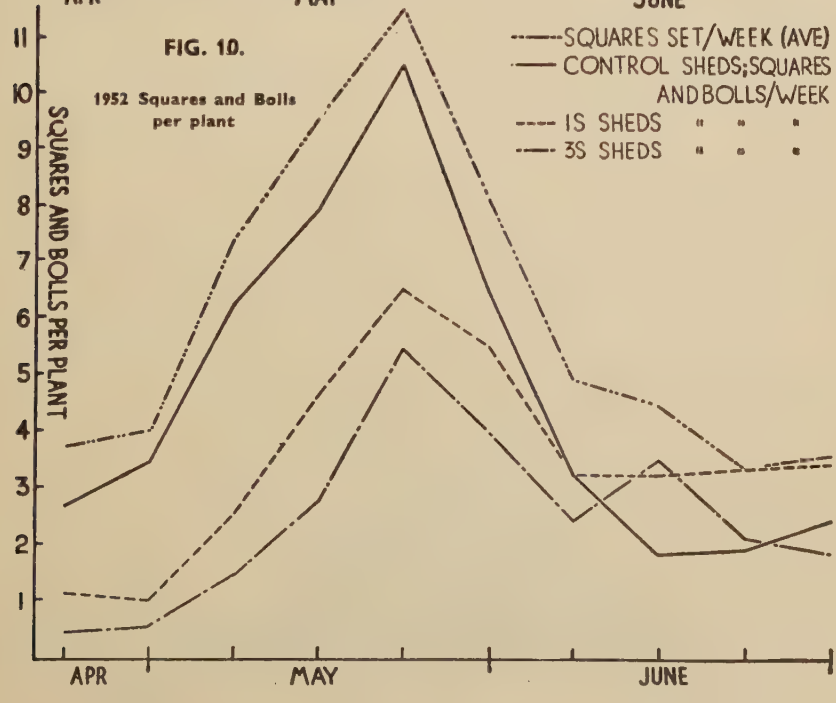
FIG. 10.
1952 Squares and Bolls per plant
SQUARES SET/WEEK (AVE)
CONTROL SHEDS; SQUARES AND BOLLS/WEEK
1S SHEDS " " "
3S SHEDS " " "
SQUARES AND BOLLS PER PLANT
11
10
9
8
7
6
5
4
3
2
1
APR
MAY
JUNE

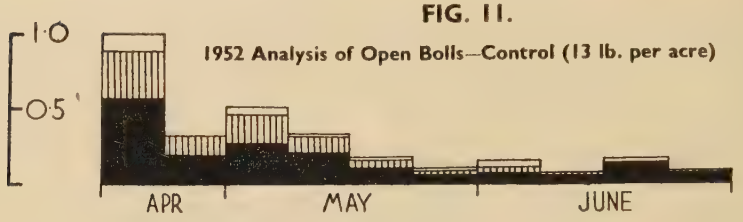

FIG. 11.

1952 Analysis of Open Bolls—Control (13 lb. per acre)

FIG. 12.

1952 Analysis of Open Bolls—
3S Treatment (1566 lb. per acre)

TABLE 5.

1952 INSECTICIDE TRIAL.

Randomised block form; plots 1/10 acre, separated by 18 ft. of giant sorghum. Strain 47/10; spacing 3′ × 3′, 2 plants per hill. Seven replications, six treatments and control. Planted 12th March.

Treatments (applied at intervals of 10 days).

1—10% DDT plus 1% gamma BHC applied 5 times.
3—10% DDT plus 3% gamma BHC applied 6 times.
A—First applied when bollworm larvae reached 1000 per acre (29th April).
S—First applied when flared squares reached 1000 per acre (2nd May).
F—First applied when flowering reached 1000 per acre (10th May).

YIELDS IN LB. SEED COTTON PER ACRE.

Treatment	*Yield*	*Significantly exceeds*	*Treatment*	*Yield*	*Significantly exceeds*
1A	839	Control	3A	1365	Control
1S	913	Control	3S	1566	All
1F	938	Control	3F	1344	Control
Control	13		Control	13	

Notes on 1952 Trial.—The main aim was to confirm previous results and to discover whether more accurate timing would give better results at the same cost. Three different timings were used, and the amount of aphicide was varied in an attempt to reduce cost.

The trial gave striking confirmation of previous results, particularly in face of a peak *Heliothis* attack of over 28,000 per acre as compared with only 7,000 in 1951.

Received April 1953.

T. BUNCLE AND CO. LTD., PRINTERS, ARBROATH.